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TITLE: Technologies for Assessing Behavioral and Cognitive Markers of Suicide Risk

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13. SUPPLEMENTARY NOTES

14. ABSTRACT

The primary aim of the proposed project is to develop cognitive and behavioral markers of suicide risk and to evaluate the predictive utility of these markers over a one year period. We propose to achieve these aims by: (a) collecting cognitive and behavioral data from Reserve component soldiers and their romantic partners in both our research laboratory and participant's homes; (b) processing these data using computer algorithms developed specifically for this study; and (c) testing the predictive accuracy of these markers using follow-up data collected from study participants over 12 months. Data collection is still in progress. There are no research findings to report at this this.

15. SUBJECT TERMS
Suicide risk assessment, suicide prevention, signal processing

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
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1. INTRODUCTION:

The primary aim of the proposed project is to develop cognitive and behavioral markers of suicide risk and to evaluate the predictive utility of these markers over a one year period. We propose to achieve these aims by: (a) collecting cognitive and behavioral data from Reserve component soldiers and their romantic partners in both our research laboratory and participant's homes; (b) processing these data using computer algorithms developed specifically for this study; and (c) testing the predictive accuracy of these markers using follow-up data collected from study participants over 12 months.

2. KEYWORDS:

Suicide risk assessment, suicide prevention, signal processing

3. ACCOMPLISHMENTS

What were the major goals of the project?

Task 1: Obtain IRB approvals
- 1a. Initiate IRB proposal (months 1-3)
- 1b. Complete annual reports to IRB (months 12-36)
- 1c. Complete final report to IRB (month 36)

Task 2: Hire and train research staff
- 2a. Hire and train postdoctoral fellow (months 1-3)
- 2b. Train research associates (months 1-3)

Task 3: Begin and complete baseline data collection
- 3a. Participant screening & enrollment (months 6-18)
- 3b. Begin baseline data collection (month 6)
- 3c. Continue baseline data collection (months 6-18)
- 3d. Complete baseline data collection (month 18)

Task 4: Begin and complete longitudinal tracking and follow-up assessments
- 4a. Begin longitudinal tracking and follow-up assessments (month 6)
- 4b. Continue longitudinal tracking and follow-up assessments (months 10-30)
- 4c. Complete longitudinal tracking and follow-up assessment (month 30)

Task 5: Use existing data to adapt and refine BSP technologies
- 5a. Refine BSP technologies for automatically generating CIRS, SSIRS, & NORS scores (months 3-18)
- 5b. Refine BSP technologies for generating feature-derived behavioral markers (months 3-18)

Task 6: Use refined BSP technologies to measure behavioral markers in study data
- 6a. Use refined BSP technologies to automatically generate CIRS, SSIRS, & NORS scores (months 18-24)
- 6b. Use refined BSP technologies to generate feature-derived behavioral markers (months 18-24)

Task 7: Generate cognitive markers in study data
- 7a. Generate cognitive markers in study data (months 18-21)

Task 8: Data analysis, manuscript writing, report writing
- 8a. Begin baseline data analyses (month 24)
- 8b. Begin data analyses of follow-up data (month 30)
- 8c. Manuscript and report writing (months 24-36)

Completion of tasks:
- 1a. 100%
- 1b. Ongoing
- 1c. Not yet started
- 2a. 100%

2b. 100%
3a. Ongoing
3b. Ongoing
3c. Ongoing
3d. Not yet started
4a. 100%
4b. Ongoing
4c. Not yet started
5a. 60%
5b. 60%
6a. Not yet started
6b. Not yet started
7a. Not yet started
8a. Not yet started
8b. Not yet started
8c. Not yet started

What was accomplished under these goals?

Major activities:

1. IRB approval obtained from the University of Utah (initial approval: September 21, 2015; final approval: November 25, 2015), University of Southern California (IRB Authorization Agreement received: September 21, 2015), and HRPO (December 1, 2015).
2. Hired two graduate research assistants, Karena Leo and Jasara Hogan, in place of planned postdoctoral hire (September 30, 2015). This decision was necessary because of the misalignment of the study start date and the academic hiring cycle.
3. Interviewed postdoctoral candidate, Feea Leifker, in collaboration with Craig Bryan (November 14, 2015). Hired Ms. Leifker with a delayed start date of August 8, 2016 due to the timing of her internship (December 3, 2015).
4. Trainings for study staff held February 12, 2016; trainings repeated August 25, 2016 to refresh initial study staff and to train new study staff.
5. Screening participants initiated February 16, 2016 and is ongoing.
6. Baseline data collection initiated February 26, 2016 and is ongoing.
7. Follow-up data collection initiated on August 8, 2016 and is ongoing.
8. Refinement of existing algorithms for automated coding initiated January 1, 2016 and is ongoing.
9. Refinement of feature-derived behavioral markers initiated March 7, 2016 and is ongoing.
10. Additional, existing data sets transferred to USC to provide additional data for refining automated coding algorithms and feature-derived behavioral markers (April 14, 2016).
11. Began drafting invited manuscript on September 20, 2016.

Specific objectives:

1. Receive University of Utah, University of Southern California, and HRPO IRB approval.
2. Fully train study staff in study procedures and emergency suicide risk assessment.
3. Begin enrollment of participants.
4. Collect baseline data from 80 couples.
5. Begin follow-up data collection.

Objectives 1, 2, 3, and 5 have been met. Objective 4 has not been met due to delays in being granted access to distributing study recruitment materials to Utah Army National Guard personnel.

What opportunities for training and professional development has the project provided?

Dr. Baucom, Dr. Bryan, and Alexander Crenshaw, M.S., attended the annual conference of the Association for Behavioral and Cognitive Therapies in New York, NY October 27, 2016 – October 30, 2016.

How were the results disseminated to communities of interest?

Nothing to report.

What do you plan to do during the next reporting period to accomplish the goals?

Our overarching strategy for achieving objective 4 during the next reporting period is to increase our ability to inform potential participants of the opportunity to participate in the study. We are going to accomplish this plan by (a) attending drill assemblies in UT and CA to distribute study information; (b) partnering with community organizations in UT and CA that serve Reservist Component personnel to distribute information through existing communication channels (e.g., listserves and newsletters) as well as at events organized by these groups; and, (c) initiating collaboration with leadership in CA and continue collaborating with leadership in UT on distributing study information.

4. IMPACT:

What was the impact on the development of the principal discipline(s) of the project?

Nothing to report.

What was the impact on other disciplines?

Nothing to report.

What was the impact on technology transfer?

Nothing to report

What was the impact on society beyond science and technology?

Nothing to report.

5. CHANGES/PROBLEMS:

Changes in approach and reasons for change

Nothing to report.

Actual or anticipated problems or delays and actions or plans to resolve them

Enrollment of study participants was slower than anticipated. We have taken several steps to increase our rate of enrollment, all of which were first discussed with and approved by Ms. Michelle Lane, the study Scientific Officer, and subsequently approved by the University of Utah and HRPO IRBs as described below. The steps we took include: (a) expanding the inclusion criteria from only current members of the Utah Army National Guard to current members of any Reserve component; (b) removing the exclusion criterion of needing to live within 25 miles of the University of Utah; (c) initiating snowball recruitment methods whereby participants voluntarily distribute study information to

others who may be interested in and eligible to participate; and (d) adding the University of Southern California as a satellite data collection site.

Changes that had a significant impact on expenditures

Nothing to report.

Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents

Significant changes in use or care of human subjects

As mentioned above, we modified the inclusion and exclusion criteria, modified recruitment methods, and added the University of Southern California as a satellite data collection site. IRB approvals for these changes were received on the dates described below:

- Changes to inclusion criteria: U of U IRB approval – 7/29/2016, HRPO approval – 8/1/2016
- Changes to exclusion criteria: U of U IRB approval – 4/12/2016, HRPO approval – 8/1/2016
- Modifications to recruitment methods: U of U IRB approval – 7/29/2016, HRPO approval – 8/1/2016
- Addition of University of Southern California as a satellite data collection site: U of U IRB approval – 8/16/2016, HRPO approval – 8/23/2016

Approvals for these amendments were not sought from the University of Southern California IRB in addition to those obtained from the University of Utah IRB because the University of Southern California officially agreed to abide by the University of Utah IRB's decision via the IRB Authorization Agreement obtained on September 21, 2015.

Significant changes in use or care of vertebrate animals

Nothing to report.

Significant changes in use of biohazards and/or select agents

Nothing to report

6. PRODUCTS:

- **Publications, conference papers, and presentations**

  Journal publications.

  Baucom, B.R.W., Bryan, C.J., Garland, E.L., Georgiou, P.G., & Narayanan, S.S. (in preparation). Technology facilitated assessment of cognitive and behavioral indicators of suicide risk. Invited submission for special issue of the International Journal of Environmental Research and Public Health, From *Understanding Suicide Risk to Preventing Suicide*, (Eds.) R. O'Connor and G. Portzky; acknowledgement of federal support (yes)

  Books or other non-periodical, one-time publications.

  Nothing to report

  Other publications, conference papers and presentations.

*Bryan, C.J., Garland, E.L., Georgiou, P.G., Narayanan, S.S., & Baucom, B.R. (August, 2016). Technology-Facilitated Assessment of Cognitive and Behavioral Indicators of Suicide Risk. In R.K. Blais (Chair), *Suicide in the Military-The Relational Context of a Leading Cause of Death in Service Members*. American Psychological Association, Denver, CO.

Li, H., Baucom, B.R.W., & Georgiou, P.G. (under review). Unsupervised latent behavior manifold learning from acoustic features: Audio2Behavior. International Conference on Acoustics, Speech, and Signal Processing, New Orleans, LA.

Li, H., Baucom, B.R.W., & Georgiou, P. (2016). Sparsely connected and disjointly trained Deep Neural Networks for low resource behavioral annotation: Acoustic classification in couples' therapy. *Interspeech*.

Nasir, M., Baucom, B.R.W., Narayanan, S.S., & Georgiou, P.G. (2016). Complexity in prosody: A nonlinear dynamical systems approach for dyadic conversations; Behavior and outcomes in couples therapy. *Interspeech*.

Tseng, S-Y., Chakravarthula, S.N., Baucom, B.R.W., Georgiou, P.G. (2016). Analysis of continuous word spaces in a Deep Learning framework for couples behavior modeling and annotation. *Interspeech*.

- **Website(s) or other Internet site(s)**

  Nothing to report

- **Technologies or techniques**

  Nothing to report

- **Inventions, patent applications, and/or licenses**

  Nothing to report

- **Other Products**

  Nothing to report.

7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

What individuals have worked on the project?

Personnel	Role	Percent effort
Baucom, Brian	Principal Investigator	.20
Bryan, Craig	Co-Investigator	.10
Garland, Eric	Co-Investigator	.16
Narayanan, Shrikanth	Co-Investigator	.33
Georgiou, Panayiotis	Co-Principal Investigator	.30
Leifker, Feea	Postdoctoral Research Manager	.166
Crenshaw, Alexander	Graduate Research Assistant	.50
Hogan, Jasara	Graduate Research Assistant	.416
Leo, Karena	Research Manager	.416

Riquino, Michael	Graduate Research Assistant	.50
Priddy, Sarah	Graduate Research Assistant	.50
Skordilis, Zisis	Graduate Research Assistant	.06
Prabakaran, Manojkuma	Graduate Research Assistant	.31
Smith, Caitlin	Graduate Research Assistant	.17
Toutios, Asterios	Graduate Research Assistant	.05
Lim, Yongwan	Graduate Research Assistant	.08
Shivakumar, Prashanth	Graduate Research Assistant	.38
Jati, Arindam	Graduate Research Assistant	.17
Li, Haoqi	Graduate Research Assistant	.38
Md Nasir, Fnu	Graduate Research Assistant	.17
Chakravarthula, Sandeep	Graduate Research Assistant	.38
Park, Tae Jin	Graduate Research Assistant	.06
Tseng, Shao-Yen	Graduate Research Assistant	.26

Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?

Nothing to report.

What other organizations were involved as partners?

Nothing to report.

8. SPECIAL REPORTING REQUIREMENTS

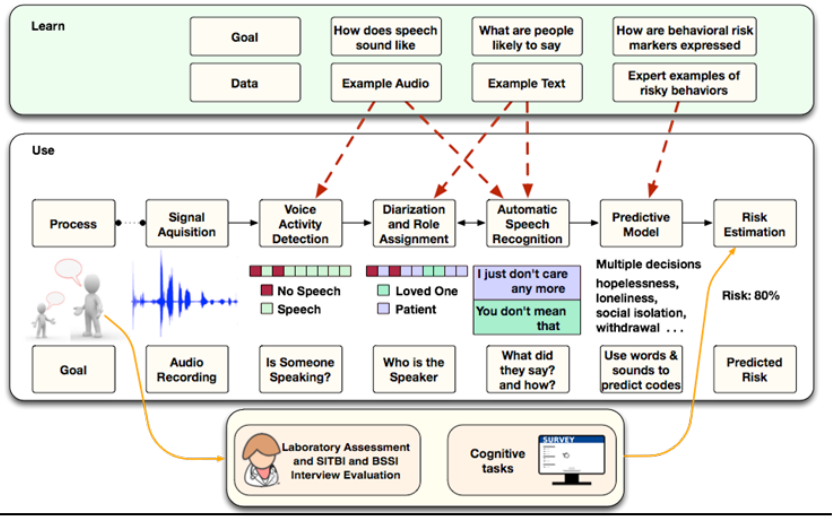
QUAD CHART:

Technologies for assessing behavioral and cognitive markers of suicide risk

PI: Brian Baucom, PhD **Org:** University of Utah

Background

- More than one death by suicide every 13 minutes amongst military personnel
- Accurate and timely assessment of suicide risk one of the most effective ways to prevent injury and death from suicide
- No reliable method for predicting suicide risk in military personnel
- Behavioral (e.g., hopelessness, reassurance seeking) and cognitive (e.g., attentional fixation on suicide-related information) markers could provide new method for objectively assessing risk for suicide
- Recent technology can be adapted for efficient, scalable, and reliable measurement of behavioral and cognitive markers
- Empowers family members by creating a risk assessment tool that can be used at home
- Rich, supplemental, information can be obtained by observing social circle in addition to patient



Approach

- Adapt existing technology for measuring behavioral and cognitive markers of suicide risk using existing data sets
- Observe behaviors of subject, loved ones, family, social circle, and identify behavioral deviations from norm
- Example behaviors of interest: hopelessness, agitation, loneliness, social isolation, engagement and entrainment.
- Collect behavioral, cognitive, interview, and self-report data from 120 couples where at least one partner is active duty National Guardsmen or Reservist in research laboratory
- Create secure internet interface for collecting data at home
- Collect behavioral, cognitive, and self-report data at home after 6 (all forms) and 12 (self-report only) months
- Apply and optimize adapted technology for use in newly collected laboratory and home data

Updated: 11.29.2016

Timeline and Cost

Activities	FY 1	FY 2	FY 3
Train BSP algorithms			
Create secure internet interface			
Collect laboratory- and home-based data from 120 couples			
Apply and refine BSP technologies			
Collect 6 and 12 month follow-up data			
Apply and evaluate adapted technology to newly collected data			
Estimated Budget ($K)	**$833**	**$833**	**$833**

RECRUITMENT GRAPH: